VI Semester Syllabi – Electronics Engineering

Sr. No.	Course Code	Course Name	L	T	P	Credits
1.	EC3CO12	VLSI Design	3	1	2	5
2.	EC3CO14	Fiber Optic Communications	3	1	2	5
3.	EC3CO16	Microwave Engineering	3	1	2	5
4.	EC3EL02	Program Elective III (Data	3	0	0	3
5.	EC3E*XX	Program Elective IV (	3	0	0	3
6.	EN3MC02	Technical English	2	0	0	0
7.	OEXXXXX	Open Elective II	3	0	0	3
		Total	**20**	**3**	**6**	24
		Total Contact Hours	29			

Program Elective (IV) List

Wireless and Mobile Communication	EC3EC05
Artificial Intelligence	EC3ET01
Low Power VLSI Design	EC3EV03

Open Elective II List

Optimization Techniques
Random Process
Data Acquisition Systems

VI Semester Syllabi – Electronics& Instrumentation Engineering

Sr. No.	Course Code	Course Name	L	T	P	Credits
1.	EI3CO12	VLSI Design	3	1	2	5
2.	EI3CO14	Fiber Optic Communications	3	1	2	5
3.	EI3CO16	Process Control	3	1	2	5
4.	EI3EL02	Program Elective-III (Data	3	0	0	3
5.	EI3ELXX	Program Elective-IV	3	0	0	3
6.	EN3MC02	Technical English	2	0	0	0
7.	OEXXXXX	Open Elective-II	3	0	0	3
		Total	**20**	**3**	**6**	**24**
		Total Contact Hours	29			

Program Elective (IV) List

Wireless and Mobile Communication	EI3EC05
Artificial Intelligence	EI3ET01
Low Power VLSI Design	EI3EV03

Open Elective II List

Optimization Techniques

Random Process

Data Acquisition Systems

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EC3ET01 /EI3ET01	Artificial Intelligence	3	0	0	3

UNIT I

Introduction to artificial intelligence, various types of production systems, Characteristics of production systems, Study and comparison of breadth first search and depth first search techniques.

UNIT II

Optimization Problems: Hill-climbing search Simulated annealing like hill Climbing, Best first Search, A* algorithm, AO* algorithms etc, and various types of control strategies, Heuristic Functions, Constraint Satisfaction Problem.

UNIT III

Knowledge Representation, structures, Predicate Logic, Resolution, Refutation, Deduction, Theorem proving, Inferencing, Semantic networks, Scripts, Schemas, Frames, Conceptual dependency.

UNIT IV

Uncertain Knowledge and Reasoning, forward and backward reasoning, monotonic and nonmonotonic reasoning, Probabilistic reasoning, Baye's theorem, Decision Tree, Understanding, Common sense, Planning.

UNIT V

Game playing techniques like minimax procedure, alpha-beta cut-offs etc, Study of the block world problem in robotics.

Text Book

1. Artificial Intelligence by Elaine Rich, Kevin Knight and Nair, TMH
2. Artificial Intelligence: A Modern Approach by Peter and Norvig

Reference Books

1. Artificial Intelligence by Saroj KausikISBN, Cengage Learning
2. Nils Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kaufmann
3. David Poole, Alan Mackworth, Artificial Intelligence: Foundations forComputational Agents, Cambridge Univ. Press.
4. Artificial Intelligence and Intelligent Systems by Padhy, Oxforfd University Press,

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EC3EV03 / EI3EV03	Low Power VLSI Design	3	0	0	3

UNIT-I

Introduction: Introduction to VLSI design, Review of MOS transistor models, CMOS logic families including static and dynamic logic.

Power dissipation mechanisms: Sources of power dissipation in VLSI circuits, Physics of power dissipation in CMOS devices – Basic principle of low power design.

UNIT-II

Static Power Dissipation: Charge leakage mechanisms in MOS transistors, Technology scaling and its effect; Threshold voltage roll-off and its effect on sub-threshold current, Gate leakage – limitations of SiO2 as gate oxide, high-k dielectric and its advantages.

Low power approach: Power supply gating principles, Multiple-threshold circuits, Frequency vs. dissipation, strained Silicon MOS technology requirements.

UNIT-III

Dynamic Power dissipation –Short circuit power, switching power dissipation, Supply voltage scaling approaches: Static Voltage Scaling; Single-level Voltage Scaling (SVS), Frequency vs. dissipation.

Low power approach: Circuit level – Transistor sizing, Scaling Approaches, Architecture level – Parallel and pipeline architectures, Algorithm level – Transformations to exploit concurrency,.

UNIT-IV

Low power Architecture & Systems:

Adders: Standard Adder Cells, CMOS Adders Architectures, Low Voltage Low Power Design Techniques, Current Mode Adders.

Multipliers: Types Of Multiplier Architectures- Braun, Booth Multipliers and their performance comparison.

Memories: Sources of power dissipation in SRAMs, Low power SRAM circuit techniques, Sources of power dissipation in DRAMs, Low power DRAM circuit techniques.

UNIT-V

Power estimation techniques – logic power estimation, Simulation power analysis, Probabilistic power analysis.

Synthesis and software design for low power – Behavioral level transform, software power estimation – co-design.

Text Books

1. Gary K. Yeap, Practical Low Power Digital VLSI Design, KAP, 2002
2. Rabaey and Pedram, Low power design methodologies, Kluwer Academic,1997
3. Kiat Seng Yeo and Kaushik Roy, Low- Voltage, Low-Power VLSI Subsystems, Edition 2009, Tata Mc Graw Hill

4. Abdelatif Belaouar, Mohamed.I.Elmasry, "Low power digital VLSI design", Kluwer, 1995.

References

1. Soudris D, Piguet C and Goutis C, Designing CMOS Circuits for Low Power, Kluwer Academic Publishers, 2002 .
2. Kaushik Roy, Sharat Prasad, Low-Power CMOS VLSI Circuit Design, Wiley, 2000
3. J.B.Kulo and J.H Lou, "Low voltage CMOS VLSI Circuits", Wiley 1999.
4. A.P.Chandrasekaran and R.W.Broadersen, "Low power digital CMOS design", Kluwer,1995.

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EC3CO16	Microwave Engineering	3	1	2	5

UNIT IINTRODUCTION

RF & Microwave Spectrum. Historical Background. Typical applications of RF & Microwaves. Transmission lines and Waveguides: Circuit model for transmission lines, loss less and lossy lines, field analysis of transmission lines, Smith chart, impedance matching. Rectangular and Circular Waveguides, Concept of Mode, Characteristics of TEM, TE ,TM and Hybrid Modes; Cut-off frequency, Propagation characteristics, Wall current, Attenuation constant, Waveguide excitations.

UNIT IIPLANAR STRUCTURE

Strip Lines: Microstrip lines, coplanar structures, Slot lines, Substrate Integrated Waveguide Suspended strip lines, Fin lines – configurations, Field patterns, propagation characteristics, Design considerations. Comparison of characteristics of lines.

UNIT IIIWAVEGUIDE PASSIVE COMPONENTS

Waveguide Resonators-Rectangular & Cylindrical; Resonant frequencies, Mode structures, Q factor, Co-axial Resonators; Excitation & Coupling of cavities, Design of resonators. N-port networks – circuit representations, Z – matrix, Y – matrix, S – matrix, transmission matrix; their relationships; Attenuators, Phase shifter, Directional couplers, Bethe-hole coupler, Power divider E & H plane Tee, Magic Tee, Hybrid ring, Circulators, Isolators, Flanges, Bends, Irises, Posts, Loads.

UNIT IVSOLID STATE MICROWAVE DEVICES

Tranferred electron devices- GUNN EFFECT; negative differential resistance phenomenon, field domam formation. GUNN diode structure. Avalanche transit time devices, IMPATT, TRAPATT, BARITT diodes, parametric amplifiers.

UNIT VMICROWAVE FILTERS

Periodic Structures, Filter Design by the Image Parameter Method, Filter Design by the Insertion Loss Method, Filter Transformations, Filter Implementation, Stepped-Impedance Low-Pass Filters, Coupled Line Filters, Filters Using Coupled Resonators.

Text Books

1. David M. Pozar, "Microwave Engineering", Third Edition, Wiley India.
2. R.E.Collin, "Foundations for Microwave Engineering", Second edition, IEEE Press.
3. Samuel Y. Liao, Microwave Devices and Circuits, PHI.

Reference Books

1. M.L. Sisodia and G.S.Raghuvanshi, Microwave Circuits and Passive Devices, Wiley Eastern Ltd., New Age International Publishers Ltd.
2. I.J. Bahl and P. Bhartia," MicroSrip Transmission Lines", ArtechHouse, Inc.

WEBSITE RESOURCES

1. Online Microwave Theory & Techniques course by IIT Bombay
   http://nptel.ac.in/noc/individual_course.php?id=noc18-ee22.

List of Practicals

1 Introduction & study of Different microwave measurement instrument and components.
Design and analysis of X- BAND Rectangular and Circular waveguide using full wave simulator.

2 To study the V-I characteristics of Gunn oscillator and to observe the variation of power & frequency with the biasing voltage.

3 Characterization of a crystal detector at microwave frequency using waveguide test bench (WR 90).

4 To study the variation of output power and frequency of a Reflex Klystron with the variation of repeller voltage (Dynamic method) & hence to determine mode number, transit time, electronic tuning range (ETR) and electronic tuning sensitivity (ETS).

5 Measurement of Wavelength, Guided wave length and Frequency using Waveguide test bench (WR-90). Calculation of broad wall dimension of waveguide and plot ω-β.

6 Measurement of Unknown Impedance (Inductive, Capacitive and Resonant Windows) using Smith Chart.

7 Measurement of Coupling Factor and Directivity of Directional Coupler using Calibrated Attenuator
Design and analysis of Directional Coupler using full wave simulator.

8 Measurement of Reflection Coefficient without using Slotted line.

9 To Measure the dielectric constant of a low loss solid dielectric using waveguide test bench (WR 90).

10 To measure the Scattering Matrix of Magic Tee & E & H Plane Tee.
Design and analysis of Magic Tee & E & H Plane Tee using full wave simulator.

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EC3CO14 /EI3CO14	Fiber Optic Communication	3	1	2	5

UNIT I

Optical Fibers: Overview of Optical Fiber Communications (OFC): Motivation, optical spectral bands, key elements of optical fiber systemsThe nature of light, basic optical Laws, fiber types, waveguide equations for step index fibers, modes in step index fiber, power flow in the step index fibers, graded index fiber, modes in graded index fiber. Fiber fabrication: outside vapor phase oxidation, vapor phase axial deposition, modified chemical vapor deposition, double crucible method.

UNIT II

Signal Degradation: Signal degradation in optical fibers: absorption, scattering losses, bending loss, material dispersion, waveguide dispersion, intermodal distortion, Dispersion- modified -single mode fibers. Fiber splicing: splicing techniques, optical fiber connectors.

UNIT III

Optical Sources: Types of optical sources, Lasers: basic concepts, absorption and emission of radiation, populationinversion, optical feedback and laser oscillation, spontaneous emission, stimulated emissionand lasing, laser modes, single mode operation, non-semiconductor laser, Light emitting diodes: thedouble heterojunction LED, Planner LED, surface emitter LEDs, edge emitter LEDs, LED characteristics, optical output power, output spectrum, modulation bandwidth, reliability.

UNIT IV

Detectors and Amplifiers: Device types, optical detection principles, absorption, quantum efficiency, responsivity, long wavelengthcutoff, semiconductor photodiodes without internal gain, photodiodes with internal gain, phototransistors, Optical amplifiers: semiconductor amplifiers, fiber amplifiers.

UNIT V Advanced Systems And Applications: Wavelength Division Multiplexing, nonlinear optical effects, optical sensors, optical isolators, circulators

Text Books:

1. Senior, J M, "Optical Communication Principle and Practices", II edition Pearson Education Ltd.
2. Keiser G, "Optical Fiber communications", second edition, McGrawhill.

References:

1. Biswas Sambhu Nath, Optoelectronic Engineering", Dhanpat Rai Publication.
2. Gowar J., optical communication systems, PHI.

3. William B. Jones jr., Introduction to optical fiber communication systems, Holt, Rinchart and Winston,

List of Practicals :

1. Preparation of optical fiber (single and multi mode) for launching of light into the optical fiber and calculation of numerical aperture and V-number. Identification of single mode and multi mode fiber.
2. Measurement of attenuation loss in an optical fiber.
4. Measurement of connectorzation and splicing losses in an optical fiber system.
5. To set up a fiber optic analog link and study of PAM.
7. To set up a fiber optic digital link and study of TDM.
8. To study and measure propagation losses in an optical fiber system.
9. To study the load cell transducer characteristics of optical fiber.

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EI3CO16	Process Control	3	1	2	5

UNIT I INTRODUCTION

Process control – Need for process control Hardware elements of a process control system – Degrees of freedom – Mathematical model of thermal, hydraulic and gaseous processes – Interacting and Non-interacting systems - Servo and Regulator Operation – Batch & Continuous Process – concept of self-regulation-Dead time

UNIT II CHARACTERISTICS OF CONTROLLERS

Direct and Reverse action of a controller with suitable examples- Control modes - Characteristics of ON- OFF, Single speed floating, Proportional, Integral and derivative controllers - Characteristics of P+I, P+D and P+I+D controllers – Response of controllers to Step & Ramp input signals – Servo and Regulatory response of P and PI controllers – Reset Wind-up and prevention – Derivative and Proportional kick – Bumpless transfer – Pneumatic and Electronic realization of Controllers. Selection of a controller for a particular process.

UNIT III CONTROLLER TUNING

Need for controller tuning – Evaluation criteria – Quarter Decay Ratio, IAE, ISE and ITAE - Types of controller tuning: Process reaction curve method, Continuous cycling method and Damped oscillation method.

UNIT IV FINAL CONTROL ELEMENTS

I/P, P/I converters – Final control elements – Pneumatic and electric actuators – Types of control valves – Valve positioner and its importance – Inherent and Installed characteristics of control valve – Control valve sizing - Cavitation and flashing.

UNIT V MULTILOOP CONTROL

Cascade control – Feed forward control – Ratio Control – Inferential control –Split-range control- Application in Distillation columns, Chemical Reactors, Heat Exchangers and Boiler– Introduction to adaptive control.

Text Books

1. Stephanopoulis, G, "*Chemical Process Control*", Prentice Hall of India, New Delhi.
2. Eckman, D.P., "*Automatic Process Control*", Wiley Eastern Ltd., New Delhi.
3. Johnson .C.D., "*Process Control Instrument Technology*", Prentice Hall.

References

1. Harriott .P.," *Process Control*", Tata McGraw Hill.
2. Anderson .N.A., "*Instrumentation for Process Measurement and Control*", Chilton company.
3. Wayne Bequette ., "*Process Control: Modeling design and Simulation*",. SRM (E&T)

List of Practicals

1. To study and analysis various process through their mathematical models (Lumped and distributed).
2. Study and analysis of P & I controllers in terms of their stability, tracking, regulatory performance for I & II orders systems.
3. Study and analysis of composite controller in terms of their stability, tracking, regulatory performance for I & II orders systems.
4. Tuning of PI & PID controllers using ZN method.
5. Tuning of PI & PID controllers using process reaction curve method.
6. To study of Electro - Pneumatic Trainer kit and Pneumatic control valves.
7. To study cascade feed forward and split range control schemes for liquid level system.
8. To study and analyze controller schemes for disturbed system

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EC3CO12 / EI3CO12	VLSI Design	3	1	2	5

UNIT I

Introduction, VLSI designs Flow, Y-chart, Moore's law, MOS transistors (Enhancement type): structure and operation, I-V characteristics, Threshold voltage, channel length modulation, body effect. MOS transistor as a switch, pass transistor logic, Tristate inverter, transmission gate operation, transmission gate logic: logic gates, multiplexers, latches and registers.

UNIT II

MOS inverters: Resistive Load Inverter, Inverters with n-type MOSFET Load, CMOS inverter: structure, operation, voltage transfer characterstics, switching threshold, noise margin, delay characteristics, power dissipation. Static CMOS: combinational logic circuits, XOR, XNOR gates, half adder, full adder, SR latch, D latch.

UNIT III

Synchronous sequential circuits: Finite state machine, state graph, state table,mealy and moore machines, conversion between mealy and moore machines, Excitation table of flip-flops, synthesis of synchronous sequential circuits, state equivalence and machine minimization, simplification of incompletely specified machines.

UNIT IV

Asynchronous sequential circuits, Fundamental mode circuits, synthesis, Races and cycles, secondary state assignment, pulse mode circuits, hazards in combinational circuits, essential hazards, hazard free realization using SR flip flops. Algorithmic state machine (introduction).

UNIT V

Programmable logic devices: PROM, PLA, PAL, programmable interconnects, logic realization by using PLDs, Study of PAL16L8, CPLD, FPGA.

IC fabrication: Basic steps of IC fabrication, CMOS n-well, p-well, twin-tub processes, Bipolar technology. Layout design rules.

Text Books

1. Neil Weste and D. Harris: CMOS VLSI Design, Pearson Education India
2. Kohavi: Switching & Finite Automata Theory, TMH
3. Kang and Leblebici:CMOS Digital Integrated Circuits: Analysis and Design, TMH
4. S.M.Sze: VLSI Technology , TMH

References

1. Neil Weste and Eshragian: Principles of CMOS VLSI Design, Pearson Education India
2. W. Wolf, Modern VLSI Design – System on Chip Design, Pearson Education
3. Lee: Digital Circuits and Logic Design, PHI Learning.
4. Roth Jr.: Fundamentals of Logic Design, Jaico Publishing House

List of Practicals

1. Design CMOS Inverter using S-edit and getting its transient response.
2. Design Universal gates and all other gates using S-edit and getting its transient response.
3. Obtain the DC- characteristics of CMOS Inverter using DC-analysis.
4. Design Symbol of CMOS Inverter and using instances of its getting transient response.
5. Design Symbol of Universal gates and using instances of them getting transient response.
6. Design a Half Adder and Full adder using instances.
7. Design a Transmission gate using PMOS & NMOS by instance calling.
8. Design of D flipflop using transmission gate.
9. Design the Layout of NMOS and PMOS transistor.
10. Design the Layout of CMOS Inverter.

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EC3EC05	Wireless &Mobile Communications	3	0	0	3

UNIT I

Introduction

Introduction to wireless communications: history and evolution, current wireless communication systems, requirements of wireless services and technical challenges of wireless communications

UNIT II

Propagation mechanism and performance analysis

Radio wave propagation in the mobile environment: Free-space propagation, Multipath scenario, large scale and small scale fading, signal time spreading, time variance of the channel caused by motion,

UNIT III

Wireless Access

Path loss models: fading channel coefficient, Characterization of fading channel, performance analysis of fading channel, mitigating the degradation effect of fading-diversity technique and interleaver.

UNIT IV

Cellular Systems:

Evolution of cellular systems, principles and operation of cellular systems, narrowband systems: FDMA and TDMA systems, frequency planning, and capacity considerations, CDMA wideband systems: resource allocation, soft handover, power control, interference and capacity, OFDM wideband systems, and Standardized cellular communications systems.

UNIT V

Wireless Network Standards:

Wireless LANs, wireless MANs, short range wireless networks, standards, capabilities and applications, broadband wireless networks, and integration of different types of wireless networks

Text Books

1. Wireless Communications", A. Goldsmith, Cambridge University Press.
2. Wireless Communications", A. Molisch, Wiley-IEEE.
3. Cellular and Mobile Communication", W. C. Y Lee, TMH.
4. Wireless Communications: Principles and Practice", T. S. Rappaport, Prentice Hall.
5. Fundamentals of Wireless Communications", D. Tse and P. Viswanath, Cambridge University Press.
6. Digital Communications", B. Sklar, P K Ray, Pearson.

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
OEXXXXX	**Optimization Techniques**	3	0	0	3

UNIT I Introduction to Optimization Techniques

Engineering applications of Optimization, Statement of an Optimization problem: design vector, design constraints, constraint surface, objective function, objective function surfaces; Classification of Optimization problems. Classical Optimization Techniques: Single variable Optimization; Multi variable Optimization without constraints: necessary and sufficient conditions for minimum/maximum; Multivariable Optimization with equality constraints: Solution by method of Lagrange multipliers; Multivariable Optimization with inequality constraints –Kuhn – Tucker conditions.

UNIT II Linear Programming

Standard form of a linear programming problem; Geometry of linear programming problems Definitions and theorems ; Linear programming problem-simplex method, Two Phases of the Simplex Method, Duality, Mixed-integer programming. Goal programming, Quadratic programming, Transportation models and its variants, Sequencing problem, Replacement theory.

UNIT III Unconstrained Nonlinear Programming

One dimensional minimization methods and Classification, Fibonacci method and Quadratic interpolation method; Quadratic interpolation method; Newton method; Unconstrained Optimization Techniques: Univariant method, Powell's method and steepest descent method.

UNIT IV Constrained Nonlinear Programming

Characteristics of a constrained problem; Classification ; Complex method ;Sequential linear programming; Basic approach of Penalty Function method : convex programming problem; Basic approaches of Interior and Exterior penalty function methods .

UNIT V Dynamic Programming

Formulation of Multi stage decision problem–Characteristics; Concept of sub-optimization and the principle of optimality; Formulation of Dynamic programming–Backward and Forward recursion; Computational procedure–Conversion offinal value problem in to Initial value problem.

Text Books

1 Singiresu S. Rao "Engineering Optimization: Theory and Practice", Fourth Edition ,John Wiley &Sons, Inc.
2 Hillier and Lieberman "Introduction to Operations Research", TMH.
3 R.Panneerselvam, "Operations Research", PHI.
4 HamdyATaha, "Operations Research –An Introduction", Prentice Hall India.

References:

1 Philips, Ravindran and Solberg, "Operations Research", John Wiley.
2 Ronald L.Rardin, "Optimization in Operation Research" Pearson Education Pvt. Ltd. New Delhi.

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
OEXXXXX	**Data Acquisition Systems**	3	0	0	3

UNIT I INTRODUCTION

Objective of DAS, Generalities about data acquisition and processing, General structure of a system of data acquisition and processing , Single Channel DAS, Multi Channel DAS, Components used in DAS, Graphical Interface (GUI) Software for DAS, Remote Terminal Unit (RTU), PC-Based data acquisition system

UNIT II DATA ACQUISITION SYSTEM (DAS)

Digital to Analog Converters (DAC), Operating principles and implementation of DAC, Characteristics of DAC- Resolution, Linearity, Monotonicity, Settling time, Digital to Analog converter DAC0804

Analog to Digital Converters (ADC), Operating principles and implementation of ADC, Characteristics of DAC- Resolution, Linearity, Monotonicity, Settling time, Analog to Digital converter ADC 0804

UNIT III DATA ACQUISITION TECHNIQUES

Analog and digital data acquisition, Sensor/Transducer interfacing, Unipolar and bipolar transducers, Sample and hold circuits, Interference, Grounding and Shielding

UNIT IV DATA ACQUISITION WITH OP-AMPS

Operational Amplifiers, CMRR, Slew Rate, Gain, Bandwidth. Zero crossing detector, Peak detector, Window detector. Difference Amplifier, Instrumentation Amplifier (IA), Interfacing of IA with sensors and transducer, Basic Bridge amplifier and its use with strain gauge and temperature sensors, Filters in instrumentation circuits

UNIT V DATA TRANSFER TECHNIQUES

Serial data transmission methods and standards RS 232-C: specifications connection and timing, 4-20 mA current loop, GPIB/IEEE-488, LAN, Universal serial bus, HART protocol, Foundation- Fieldbus, ModBus, Zigbee and Bluetooth.

Course Learning Outcomes (CLO):

After the successful completion of the course the students will be able to:

1. Explicate the elements of data acquisition techniques.
2. Design and simulate signal conditioning circuits.
3. Elucidate various data transfer techniques
4. Understand the components of data acquisition system

Text Books

1. Coughlin, R.F., Operational Amplifiers and Linear Integrated Circuits, Pearson Education
2. Kalsi, H.S., Electronic Instrumentation, Tata McGraw Hill
3. Gayakwad, R.A., Op-Amp and Linear Integrated Circuits, Pearson Education

4. Mathivanan, N., Microprocessor PC Hardware and Interfacing, Prentice Hall of India Private Limited
5. Dinesh K. Anvekar & B.S. Sonde, Electronic Data Converters-Fundamentals & applications, Tata McGraw Hill

Reference Books

1. Ananad, M.M.S., Electronic Instruments and Instrumentation Technology, Prentice Hall of India Private Limited
2. Murthy, D.V.S., Transducers and Instrumentation, Prentice Hall of India Private Limited
3. Hermann Schmid, Electronic Analog/Digital Conversions, Tata McGraw Hill

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
EC3EL02 / EI3EL02	Data Communication and Computer Networks	3	0	0	3

UNIT I

Overview of data communication, Introduction to computer networks: network criteria and application, protocol and standards, line configuration, topologies, categories of networks. Concepts of layering and layered model: OSI reference model, TCP/IP reference model, their comparative study.

The Physical Layer: Introduction to physical layer-data and signal, digital data transmission, parallel and serial transmission, transmission impairments, channel capacity, performance metrics of networks, overview of bandwidth utilization: multiplexing schemes, concepts of switching: Circuit switching: time division & space division switch, TDM bus, message switching and packet switching.

UNIT II

The Data Link Layer: Error detection techniques: Parity check, Vertical and longitudinal redundancy check, CRC code and checksum. Data link layer issues-Point to point and multipoint links, flow control, sliding window protocol, various ARQ techniques for error and flow control and their comparison, HDLC as bit oriented link control. Multiple access control protocols- Pure and slotted ALOHA, CSMA, CSMA/CD, CSMA/CA Protocol.

UNIT III

The Network Layer: Duties of network layer, Design Issues, Concept of Internetworking & devices-Repeaters, Hubs, Bridges, Switches, Router and Gateway. Routing algorithms-shortest path algorithm, flooding, distance vector routing and link state routing. Internet addressing- IP addressing scheme, IPv4 protocol, IPv6 protocol.

UNIT IV

The Transport Layer: Duties of transport layer, Design issues and services, Congestion control algorithm-Leaky bucket algorithm, Token bucket algorithm, choke packets, Quality of service-techniques to improve QoS, User Datagram Protocol and Transmission Control Protocol.

The Application layer: Duties of application layer, Design issues and services, client server model, domain name system.

UNIT V

Wired and wireless networks: A brief survey of IEEE LAN standards. Comparative study of Ethernet, Fast Ethernet, Gigabit Ethernet and 10 Gigabit Ethernet, IEEE802.11, ISDN, ATM network- ATM architecture, ATM layers.

References

1. Forouzan: Computer Networks, TMH.
2. Forouzan: Data Communication and Networking, TMH.

3. Tanenbaum: Computer Networks, Pearson Education.
4. Bertsekas and Gallager: Data Networks, PHI Learning.
5. Stallings: Computer Networking and Internet Protocol, Pearson Education.
6. Black: Computer Networks, PHI Learning.
7. Keiser: Local Area Network, TMH.
8. Gupta: Data Communications and Computer Networks, PHI Learning.

Course Code	Course Name	Hours per Week			Total
		L	T	P	Credits
OEXXXXX	Random Process	3	0	0	3

UNIT I

RANDOM VARIABLES

Probability –Axioms of probability Conditional probability, Baye's theorem, Probability Distributions: Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions. Discrete, continuous and mixed random variables, probability mass function, probability density function, cumulative distribution functions, Expectation , Moments, Moment generating functions, Markov inequality , Chebyshev inequality.

UNIT II

DIMENSIONAL RANDOM VARIABLES

Joint distributions, Marginal and conditional distributions, Covariance, Correlation, Regression, Transformation of random variables, Central Limit Theorem.

UNIT III

RANDOM PROCESSES

Classification, Stationary, Nonstationary and Wide-Sense stationary processes , Gaussian Process, Markov process, Poisson process, Random telegraph process.

UNIT IV

SPECTRAL CHARACTERISTICS

Auto correlation functions, Cross correlation functions, Properties, Power spectral density, Cross spectral density, Properties, White Gaussian Random Process,.

UNIT V

LINEAR SYSTEMS RESPONSE

Linear time invariant system , System transfer function , Linear systems with random inputs , Auto correlation, Cross correlation functions and power spectral density of output, Bandpass Random Process, Wiener Hopf filter.

Text Books

1. Miller. S.L. and Childers. D.G., "Probability and Random Processes with Applications to Signal Processing and Communications", Academic Press.
2. S. Palaniammal, "Probability and Random Processes", PHI.

References

1. Ibe.O.C., "Fundamentals of Applied Probability and Random Processes", Elsevier, 1st Indian Reprint.
2. Hwei Hsu, "Schaum"s Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata Mc Graw Hill, New Delhi.